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## CLAIMS

1. A method for forming a thin film magnetic recording media, the method comprising:
  - 5 generating magnetic nanoclusters;
  - crystallizing the magnetic nanoclusters;
  - depositing the magnetic nanoclusters onto a substrate to form a thin film of magnetic particles thereon,
- 10 2. The method as recited in claim 1, wherein the magnetic nanoclusters are deposited onto the substrate after crystallized.
3. The method as recited in claim 1, wherein the substrate is not heated during deposition.
- 15 4. The method as recited in claim 1, wherein the magnetic nanoclusters are crystallized by being heated in gas phase.
5. The method as recited in claim 1, further comprising mixing the magnetic  
20 nanoclusters with a non-magnetic material.
6. The method as recited in claim 5, further comprising encapsulating the magnetic nanoclusters with the non-magnetic material.
- 25 7. The method as recited in claim 6, wherein the non-magnetic material comprises an organic solvent.
8. The method as recited in claim 6, wherein the non-magnetic material comprises a surfactant.
- 30 9. The method as recited in claim 5, wherein the mixing is performed before the magnetic nanoclusters are crystallized.

10. The method as recited in claim 9, wherein crystallizing of the magnetic nanoclusters comprises heating the magnetic nanoclusters and fixing the non-magnetic material onto the magnetic nanoclusters.
11. The method as recited in claim 5, wherein the mixing is performed after the magnetic nanoclusters are crystallized.
12. The method as recited in claim 1, further comprising providing a magnetic field adjacent to the substrate to control the orientation of the magnetic particles upon deposition.
13. The method as recited in claim 11, wherein each of the magnetic particles has an easy axis parallel to a surface of the substrate.
14. The method as recited in claim 13, wherein the easy axes are parallel relative to each other.
15. The method as recited in claim 13, wherein the easy axes are perpendicular to the surface of the substrate.
16. The method as recited in claim 1, further comprising, during depositing of magnetic nanoclusters, depositing a non-magnetic material onto the substrate to mix with the magnetic nanoclusters.
17. The method as recited in claim 1, further comprising rotating the substrate during deposition.
18. An apparatus for forming a thin film magnetic recording medium onto a substrate, the apparatus comprising:
  - a first chamber having a source for generating magnetic nanoclusters;

a second chamber connected to the first chamber for receiving and crystallizing the magnetic nanoclusters;

a third chamber connected to the second chamber for receiving the crystallized magnetic nanoclusters and depositing the crystallized magnetic nanoclusters onto the substrate positioned therein,

wherein the magnetic nanoclusters are deposited on the substrate after crystallized.

19. The apparatus as recited in claim 18, further comprising a first supplier for providing a first non-magnetic material to encapsulate the magnetic nanoclusters.

20. The apparatus as recited in claim 19, wherein the first non-magnetic material comprises a surfactant.

21. The apparatus as recited in claim 20, wherein the surfactant comprises at least one of a group consisting of fatty acids, alkyl thiols, alkyl disulfides, alkyl nitriles and alkyl isonitriles.

22. The apparatus as recited in claim 18, further comprising a rotatable stage for holding the substrate in the third chamber.

23. The apparatus as recited in claim 18, further comprising a second supplier for depositing a second non-magnetic material onto the substrate upon deposition of the magnetic nanocrystals.

24. The apparatus as recited in claim 23, wherein the second non-magnetic material comprises at least one of a group consisting of C, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, BN and carbon hydrogenate polymer.

25. The apparatus as recited in claim 18, wherein the magnetic material comprises at least one of a group consisting of Co, Fe, Ni, Sm, Pt, Cr, Ta, Nd, Pd, Gd, B, N, C, P, Ti, W, Mo, Ag, Ru, Au, Nb, Pb, Dy.

26. The apparatus as recited in claim 25, further comprising at least one of a group consisting of a binary alloy and a ternary alloy of the magnetic material.
- 5 27. A thin film magnetic recording medium comprising:  
a substrate;  
a magnetic thin film layer disposed on the substrate, wherein the magnetic thin film layer has magnetic particles isolated by a non-magnetic content,  
wherein the magnetic particles are formed on the substrate after crystallization.
- 10 28. The thin film magnetic recording medium as recited in claim 27, wherein each of the magnetic particles has a magnetic easy axis that is anisotropically orientated.
29. The thin film magnetic recording medium as recited in claim 27, wherein the  
15 magnetic particles having a dimension of less than about 8 nm.
30. The thin film magnetic recording medium as recited in claim 29, wherein the magnetic particles having a distribution width of less than about 10%.
- 20 31. The thin film magnetic recording medium as recited in claim 27, wherein the non-magnetic content comprises at least one of a group consisting of fatty acids, alkyl thiols, alkyl disulfides, alkyl nitriles and alkyl isonitriles.
32. The thin film magnetic recording medium as recited in claim 27, wherein the non-  
25 magnetic content comprises at least one of C, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, BN and carbon hydrogenate polymer.
33. The thin film magnetic recording medium as recited in claim 27, further comprising a protective overcoating disposed on the magnetic thin film layer.
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